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DEC 22 2010

**SECRETARY, BOARD OF
OIL, GAS & MINING**

**BEFORE THE BOARD OF OIL, GAS AND MINING
DEPARTMENT OF NATURAL RESOURCES
STATE OF UTAH**

IN THE MATTER OF THE REQUEST :	PRODUCTION OF CVS OF LIVING
FOR AGENCY ACTION OF LIVING :	RIVERS' EXPERTS; REQUEST FOR
RIVERS TO APPEAL THE DECISION :	PRODUCTION OF DOCUMENTS
BY THE DIVISION OF OIL, GAS AND :	FROM THE DIVISION &
MINING TO APPROVE THE :	EARTH ENERGY RESOURCES
APPLICATION OF EARTH ENERGY :	
RESOURCES TO CONDUCT TAR :	Docket No. 2010-027
SANDS MINING AND RECLAMATION:	
OPERATIONS AT THE PR SPRINGS :	Cause No. M/047/0090 A
MINE :	

Living Rivers hereby produces the CVs of its expert witnesses, and submits its request for production of documents from the Division of Oil, Gas and Mining (Division) and Earth Energy Resources (EER). The CV for Elliott Lips is attached as Exhibit A; the CV for Charles Norris is attached as Exhibit B.

Pursuant to the December 21, 2010 Pre-Hearing Stipulation and the following instructions, you are hereby requested to produce, by January 3, 2011, the documents requested herein at the offices of Western Resource Advocates, 150 South 600 East, Ste 2A, Salt Lake City, Utah 84102.

INSTRUCTIONS

- 1) The term "document" or "documentation" has the broadest possible meaning and includes, but is not limited to, **each** draft and final version of all writings, drawings,

graphs, charts, photographs, photo records, maps, GIS data, videos, e-mails, databases and other data compilations from which information can be obtained or translated.

- 2) Answer all requests for production separately, fully, and in writing.
- 3) If referencing, citing, referring to, or relying on any documents and/or information in the record for this matter, provide the page numbers for any such document and/or information.
- 4) If you cannot respond to any of the requests for production in full, after exercising due diligence to secure the documents, so state, and respond to this request to the extent possible, based on documents available or accessible.
- 5) If any request for production is answered by reference to a group of documents, identify the specific document or documents containing the requested information.
- 6) If anything is deleted or redacted from a document produced in response to a request for production, state the reason for the deletion or redaction and the subject matter of the deletion or redaction.
- 7) If any record, group of records, or document is withheld pursuant to an objection or claim of privilege, identify each withheld record, group of records, or document, including sufficient information to permit the claim of privilege to be evaluated.
- 8) If any request for production is withheld pursuant to an objection or claim of privilege, identify the specific request for production and subparagraph(s) requesting the withheld information, explain the basis upon which the objection is raised or the privilege is claimed, and identify all persons having knowledge of the withheld information.
- 9) If any document requested or described in the responses to these requests for production is not produced, whether it is missing, lost, destroyed, transferred to others or otherwise disposed of, describe it fully, including, but not limited to, the author, recipients and contents of the document and provide the name and last known address of any person

known to have had possession, custody or control of the document or a copy of it or any person familiar with its contents and provide an explanation as to why the document is not being attached. In the event that any such document has been destroyed, please specify the date and manner of destruction, the reason for destruction and the identification of all persons authorizing or carrying out the destruction.

- 10) Where documents with attachments are produced they should be attached in the same manner as attached to the original document; where documents are produced and all attachments thereto are not produced, identify the missing attachments and explain the reason for their non-production.
- 11) Documents attached or affixed to each other by any means, including, but not limited to, being stapled, clipped, gathered, bound together or included as part of a notebook of any kind should not be separated, whether or not responsive to these requests.
- 12) Copies of file folders (or the original file folders if original files are produced) from which documents are produced should also be produced if there are any written notations therein.
- 13) If, in response to these requests, any ambiguity arises in construing any request or instruction, set forth the matter deemed ambiguous or vague and the interpretation on which you base your response.
- 14) In answering these requests, provide all information that is available to you, including information in the possession of your attorneys, consultants, investigators, representatives or other agents.
- 15) For the convenience of the parties, please restate in full the request to which each response or answer relates.
- 16) These requests for production are to be deemed continuing in nature. Supplemental answers are requested in the event that you subsequently obtain or become aware of the

- 17) If you object to any requests for production, state the legal objections, the facts upon which you are objecting to the interrogatory or request for production and cite any supporting case law.
- 18) These requests for production of documents cover all information and documents in your possession, control, or custody or in that of your officials, employees, agents, consultants, servants, contractors, attorneys and assigns.
- 19) Provide responses to these requests for production by January 3, 2011. If you cannot complete these requests within this time, provide immediate notice to Living Rivers' counsel so that an amicable resolution to the problem can be reached.

- **REQUEST FOR PRODUCTION NO. 1:**

Please provide all documents that show results of all analysis of surface water runoff under existing conditions and projected post-mining conditions, including but not limited to model used, inputs, data, maps, and model results for entire mine site.

- **REQUEST FOR PRODUCTION NO. 2:**

Please provide all documents that show results of all analysis of sediment yield under existing conditions and projected post-mining conditions, including but not limited to model used, inputs, data, maps, and model results for the overburden/interburden storage areas.

- **REQUEST FOR PRODUCTION NO. 3:**

Please provide all documents that show data on surface water quantity collected in the permit and adjacent areas including, but not limited to, sample locations, sample dates and times, estimated flows, and discussion of sampling technique.

- **REQUEST FOR PRODUCTION NO. 4:**

Please provide all documents that show data on surface water quality collected from samples in the permit and adjacent areas including, but not limited to, sample locations, sample dates and times, estimated flows, discussion of sampling technique, results of water quality analysis including field parameters and laboratory data sheets, and quality assurance / quality control plan and samples.

- **REQUEST FOR PRODUCTION NO. 5:**

Please provide all documents that show data on ground water quantity collected from wells and from seeps and springs in the permit and adjacent areas including, but not limited to, sample locations, sample dates and times, estimated flows, and discussion of sampling technique.

- **REQUEST FOR PRODUCTION NO. 6:**

Please provide all documents that show data on ground water quality collected from wells and from seeps and springs in the permit and adjacent areas including, but not limited to, sample locations, sample depths/elevations, sample dates and times, estimated flows or water surface elevation, discussion of sampling technique, results of water quality analysis including field parameters and laboratory data sheets, and quality assurance / quality control plan and samples.

- **REQUEST FOR PRODUCTION NO. 7:**

Please provide all documents that show geologic logs and driller's reports (including but not limited to reports of drilling methods, recovery, drilling fluids, casing, completion records) for all wells drilled at the site.

- **REQUEST FOR PRODUCTION NO. 8:**

Please provide all documents that show geologic cross-sections, transects, or profiles generated from geologic maps and from well and seep and spring data.

- **REQUEST FOR PRODUCTION NO. 9:**

Please provide any documentation of seep and spring inventory including but not limited to maps showing area surveyed and notes.

- **REQUEST FOR PRODUCTION NO. 10:**

Please provide any documentation of existing surface water features including but not limited to identification on maps of reaches of streams that are perennial, intermittent, and/or ephemeral.

- **REQUEST FOR PRODUCTION NO. 11:**

Please provide any documentation that includes a detailed description of the full stratigraphic section that will be mined and processed, from which the variations in ore can be determined.

- **REQUEST FOR PRODUCTION NO. 12:**

Please provide any documentation that includes a detailed description of the ore rock for each of the variable strata identified in the detailed description of the stratigraphy, including: elemental analyses of the ore (combined rock and organic matter); elemental analyses of the organic matter; mineralogical analyses of the ore (combined rock and organic matter); mineralogical analyses of the organic matter; analyzes of sulfur partitioning (total sulfur, sulfate, sulfite, elemental sulfur, and sulfide) of ore (combined rock and organic matter); analyzes of sulfur partitioning (total sulfur, sulfate, sulfite, elemental sulfur, and sulfide) of organic matter.

- **REQUEST FOR PRODUCTION NO. 13:**

Please provide any documentation that includes a detailed description of waste rock analyses, including: elemental analyses of the waste rock; mineralogical analyses of the organic waste; analyzes of sulfur partitioning (total sulfur, sulfate, sulfite, elemental sulfur, and sulfide) of waste rock.

- **REQUEST FOR PRODUCTION NO. 14:**

Please provide any documentation that includes a detailed description of any leaching tests conducted, including: test protocols and leaching results of all column leaching tests performed on ore rock; test protocols and leaching results of all column leaching tests performed on waste rock; test protocols and leaching results of all high solid:liquid ratio leaching tests performed on ore rock; test protocols and leaching results of all high solid:liquid ratio leaching tests performed on waste rock; test protocols and leaching results of all long-duration leaching tests performed on ore rock; test protocols and leaching results of all long duration leaching tests performed on waste rock; test protocols and leaching results of all other leaching tests performed on waste rock and ore rock except those presented as part of the application materials; the discussion for each of the above leaching protocols relating the leaching results relative to the quality of leachate that will form at the mine upon disposal.

- **REQUEST FOR PRODUCTION NO. 15:**

Please provide any documentation that includes Material Safety Data Sheets for each of the chemicals/materials used in the chemical mix and sequence used to extract the organic matter or recover the process chemical(s).

- **REQUEST FOR PRODUCTION NO. 16:**

Please provide any documentation that includes results of any toxicity testing done on each of the chemicals/materials used in the chemical mix and sequence used to extract the organic matter or recover the process chemical(s)

Dated: December 22, 2010



ROB DUBUC
JORO WALKER
Attorneys for Living Rivers

CERTIFICATE OF SERVICE

I hereby certify that on this 22nd day of December, 2010, I served a true and correct copy of this Production of CVs and Requests for Production of Documents to each of the following persons via email:

Mike Johnson
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ROB DUBUC

Exhibit A

CURRICULUM VITAE

Elliott W. Lips, P.G.
Great Basin Earth Science, Inc.
2241 East Bendemere Circle
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SUMMARY OF EXPERIENCE

Mr. Lips is a licensed professional geologist with 27 years experience in engineering geology and geomorphology in the western United States. He has conducted research, consulted, taught university classes, and provided expert witness testimony on geologic hazards, engineering geology, dam evaluations, mine reclamation and permitting, Earth surface processes, and environmental studies. Mr. Lips is currently the Principal Engineering Geologist of Great Basin Earth Science, Inc.

ACADEMIC AND PROFESSIONAL QUALIFICATIONS

Ph.D. A.B.D., Geography, University of Utah, Salt Lake City, Utah
M.S., Geology, Colorado State University, Fort Collins, Colorado, 1990
Graduate courses in Engineering, University of California, Berkeley, 1984-1985
B.A., Geology and Physics, Western State College, Gunnison, Colorado, 1983
Registered Professional Geologist, State of Wyoming No. 1489
Licensed Professional Geologist, State of Utah No. 5529142-2250
Member, Geologic Peer Review Board, Morgan County, Utah, 2008-present

PROFESSIONAL HISTORY

Great Basin Earth Science, Inc., Principal Engineering Geologist, 1995 - Present
Responsible for all aspects of providing consulting services for geologic hazard evaluations including faults, landslides, floods, debris flows, and rockfalls; surface and ground water investigations; stream characterization and restoration evaluations; geologic/seismic dam safety evaluations; and environmental and paleoenvironmental reconstructions.

University of Utah, Adjunct Associate Professor, 1999 - 2006; Adj. Assist. Professor, 1996 - 1999
Responsibilities include developing curriculum and teaching courses on geomorphology and surficial processes, geologic hazards, climate change, environmental studies, and natural resource management.

AGRA Earth & Environmental, Engineering Geologist, 1992 - 1995
Project manager for engineering geologic and geologic hazard investigations. Projects were for existing, proposed, and reclaimed mines, proposed subdivisions, utility corridors, commercial developments, and dams.

JBR Consultants Group, Engineering Geologist, 1985 - 1992

Project manager for engineering geologic investigations and mine permitting and reclamation projects throughout the western United States. Directed data collection and analysis, and prepared technical reports and permitting documents for new developments, proposed and existing mining operations, and for abandoned mines.

U.S. Geological Survey, Geologist, 1983 - 1985

Conducted research on landslides, floods, and debris flows in the western U.S. (primarily in central Utah); prepared publications on processes, recent events, methods of evaluations, and methods of risk assessment.

REPRESENTATIVE RESEARCH AND CONSULTING EXPERIENCE

Geologic Hazards Evaluations

Landslide Vulnerability Assessment, Project Impact, Salt Lake City, Utah: Served as chair of committee of geologists and engineers and was lead author of final report to Salt Lake City. Project consisted of conducting investigations and assessing the vulnerability for all property within the limits of Salt Lake City that could be impacted by landslides. In addition, lifelines entering the city, which if damaged or destroyed by landslides, would potentially result in loss of life and/or serious economic impact to the residents of the city, were considered.

Geologic Hazards Identification and Evaluation, Draper, Utah: Conducted evaluation of geologic hazards at two sites for a proposed salt storage facility in the Traverse Mountains, Draper, Utah. Hazards evaluated included landslides, debris flows, rock falls and surface fault rupture.

Landslide and Debris-Flow Hazard Evaluation, Central Utah: Evaluated the potential for debris flows and debris floods for a 30-mile portion of the Wasatch Front. Evaluated and rated more than 90 canyons in the project area for their potential to generate an event that could impact residential communities. Conducted reconnaissance of landslides and debris flows throughout central Utah during the period of high landslide activity in 1984. Provided reports to the Utah Geological Survey on conditions of landslides and debris flows that posed hazards, and provided 24-hour emergency assistance to City and County personnel by identifying and evaluating landslides, debris flows and flood hazards.

Geologic Hazards Evaluations, Utah and Wyoming: Evaluated site conditions at approximately 30 individual residential lots and proposed subdivisions (up to 3000 acres in size) to assess geologic hazards including seismic hazards, surface and ground-water impacts, landslides, and collapsible soils. Reports have been prepared in support of obtaining approval for septic drain fields, building permits, and subdivision approval.

Erosion and Sedimentation Evaluations

Sediment Yield Evaluation, Grants, New Mexico: Determined erosion rates, soil loss, and sediment yield from an 8,000-acre area disturbed by open-pit uranium mining. Developed a site-specific model that considered soil loss contributions from sheetwash, rill, gully, and stream-bank erosional processes. Sediment yield was evaluated for existing, post-reclamation, and pre-mining conditions at eight locations where drainages exited the mine site. The model results were tested by comparing the estimated sediment yield to the measured sediment accumulation in a downstream reservoir.

Erosion and Sediment Transport Investigation, Central Utah: Performed field measurements in ephemeral channels to document bank erosion, deposition, and impacts from past mining activities. Measured and mapped erosion features on disturbed slopes and mine waste piles, and evaluated their potential as sediment source contributors to the watershed drainage network. Calculated expected erosion rates and volumes, and modeled sediment transported in the stream channels. Assessed historic downstream deposition of tailings material.

Stream Channel and Floodplain Restoration Designs

Stream Channel Stability Evaluations and Design, Salina, Utah: Conducted an evaluation of two stream channels at a reclaimed mine site that had been damaged by high-runoff events. Channel stability was evaluated by considering the geomorphic setting, previous channel designs, stable upstream reaches, and examples from the literature. Prepared designs for reconstruction of the channels incorporating a series of buried grade control structures. Provided assistance in permitting the design and developed a program for construction supervision.

Stream Channel and Floodplain Evaluations and Design, Salt Lake City, Utah: Conducted an evaluation of existing hydrology on a 200-acre portion of the Jordan River Floodplain. Surface water features were surveyed and quantified; ground water flow was modeled based on data obtained from shallow bore holes. Designs were prepared for channels that would transfer surface water to dry parts of the floodplain in order to enhance shallow ground water available to plants. The project goals were to reestablish native floodplain vegetation to provide habitat for migratory birds. Channels were also designed to convey runoff from an adjacent site to the project area.

River Restoration, Carbon County, Utah: Designed a realignment and restoration of a 1,500-foot reach of the Price River that had been impacted by coal mining. Reviewed peak flows for various return-interval events, evaluated geomorphic stability, flow hydraulics, sediment transport, aesthetics, wildlife habitat, and costs to develop designs for river and floodplain restoration. Developed several conceptual design alternatives for client review and rated each alternative based on effectiveness, costs, long-term stability, maintenance requirements, permit considerations, and constructability.

Surface and Ground Water Investigations

Investigation of Lake Flooding, Southern Utah: Conducted an evaluation of the cause of recent flooding on property adjacent to Quichapa Lake. Investigations consisted of evaluation of aerial photographs, topographic maps, records of historic floods, climate records, vegetation, and playa sediments. Site investigations included flood boundary mapping and surveying, inspection of hydraulic control structures and channel geomorphic features, collection of tree sections for dating, and collection of sediment cores in order to determine cause of flooding and history of flooding in the lake basin.

Investigation of Flood Sources, Central Utah: Conducted an evaluation of the cause of recent flooding on property adjacent to the Sevier River. Investigations consisted of evaluation of aerial photographs, topographic maps, records of historic floods, and determining flood magnitudes and recurrence intervals. Site investigations included floodplain mapping and surveying, aerial reconnaissance during flood events, and inspection of hydraulic control structures in order to determine source of flooding.

Investigation of Potential Sources of Seepage, Great Salt Lake Beach, Utah: Conducted an evaluation of seepage and beach saturation in a complex industrial and hydrogeologic setting. Investigation consisted of reviewing reports of previous investigations, conducting field investigations and surveys, conducting finite element seepage modeling of ground-water flow, and investigating surface-water management of nearby water sources.

Runoff and Sediment Control Plans, Utah and Nevada: Performed the hydrology and hydraulics analyses and designed integrated runoff control plans at numerous mine and industrial facilities ranging in size to 300 acres. Determined runoff volumes, peak flows, and sediment yield. Plans were developed that would: direct upgradient runoff from undisturbed watersheds through the sites; control runoff generated on the sites and prevent it from mixing with the undisturbed area runoff; minimize the potential for on-site runoff to contact pollutants; direct perennial seepage water through the sites; and provide treatment for site runoff prior to its leaving the sites. Structures designed as part of these runoff control networks include earth-lined channels, riprap channels, biodegradable erosion control channel protection, water bars, drop structures, culverted road crossings, synthetic lined channels, spillways, and sedimentation ponds.

Regulatory Evaluations/Project Reviews

Building Permit Review, Northern Utah: Served as a member of the Morgan County Geologic Peer Review Board for purpose of reviewing geologic and geotechnical engineering reports submitted by applicants for building permits. Conducted public meetings, performed site inspections, and prepared written comments for Morgan County on several proposed residential developments.

Environmental Impact Statement Review, Northern Utah: Conducted a review of a Draft EIS prepared by the Army Corps of Engineers for a proposed 5,000-acre expansion of a tailings impoundment. Key technical issues were potential impacts to surface and ground water, adjacent wetlands, and the Great Salt Lake. An extensive summary report was prepared identifying specific items that needed clarification and/or additional information.

Environmental Assessment Review, Southern Utah: Conducted a review of an Environmental Assessment prepared by the BLM for a proposed chaining project on public and private land. Evaluated the geologic and hydrologic investigations conducted to support the impact assessment from sedimentation and erosion.

Hydropower Project Permitting Review, Western Colorado: Conducted reviews of the Draft and Final EIS, the Army Corps of Engineers 404 permit application, and supporting technical documents for the proposed AB Lateral Hydropower Project. The proposed project would divert about 900 cfs from the Gunnison River to the Uncompahgre River. Evaluated the impacts to the Uncompahgre River and prepared detailed technical comments on potential changes to stream geomorphology from bed scour and bank erosion.

Dam Permit Application Review, Central Utah: Conducted a review of a Federal Energy Regulatory Commission (FERC) application for a proposed dam and hydroelectric power plant on the Fremont River, near Capitol Reef National Park. Prepared comments on the adequacy of the geologic, geotechnical engineering, and hydrologic investigations conducted as part of the application package, and potential impacts to the river within the park.

Mine Permit Application Review, Southern Utah: Conducted several reviews over a three-year period of mine permit applications submitted to the Utah Division of Oil, Gas and Mining (DOG M) for a proposed coal mine on the Kaiparowits Plateau. The hydrology and geology sections of the permit application were evaluated and written comments were prepared on the adequacy of the baseline investigations, probable hydrologic consequences, monitoring plans, and impacts to surface and ground water.

Highway Design and Construction Review, Central Utah: Conducted reviews of design drawings, and construction specifications during a three-year period of highway construction for U.S. 189 in Provo Canyon, Utah. The geologic and hydrologic components of the project were evaluated for their compliance with NEPA and the Clean Water Act. Engineering geologic components of the project were evaluated, with emphasis on slope stability of hillslopes, cuts for the roadway, impacts to the Provo River, and mitigative measures. Prepared numerous written documents based on site inspections, surveys, data analysis, and interpretation.

Mine Permit Application Review, Central Utah: Conducted several reviews over a seven-year period of mine permit applications submitted to the Utah Division of Oil, Gas and Mining (DOG M) for a proposed coal mine along the Book Cliffs. The hydrology and geology sections of the permit application were evaluated and written comments were prepared on the adequacy of the baseline investigations, probable hydrologic consequences, monitoring plans, and impacts to surface and ground water.

Dams and Water Infrastructure

Engineering Geologic Investigations – Existing Dams, Utah: Conducted investigations at 13 existing high-hazard earthen dams for various water user associations in compliance with Utah Statutes and Administrative Rules for Dam Safety. Investigations have included preparing maps of surface and bedrock geology including landslides and faults; drilling, logging, and sampling test holes in existing dams and abutments; installation and monitoring of piezometers; evaluating liquefaction susceptibility; developing earthquake design parameters from both deterministic and probabilistic methods; and preparation of maps, cross-sections, logs, and reports.

Engineering Geologic Investigations – Monks Hollow Dam Site, Wasatch, County, Utah: Conducted investigation at the site of a proposed concrete arch dam on the Diamond Fork River for the Central Utah Water Conservancy District. Investigations included review of Bureau of Reclamation geologic and seismic reports and design drawings; inspection of exploratory tunnels in abutments, mapping surficial geology and faults, evaluating fault activity, and preparation of presentations and summary report.

Engineering Geologic Investigations – Water Storage Tank, Draper, Utah: Conducted geologic hazards investigations at three sites for a proposed 2.3 million gallon water storage tank in the Traverse Mountains. Hazards evaluated included landslides, debris flows, rock falls and surface fault rupture. Test pits and trenches were excavated, geologic logs were prepared of subsurface geology, landslide and fault activity was evaluated, and reports were prepared and summarized in a presentation to the Draper City Council.

Engineering Geology and Geologic Hazards Evaluations – Canal Enclosure, Utah County, Utah: Project consisted of evaluating engineering geology and geologic hazards for a proposed 22-mile long, 144-inch diameter pipeline along the base of the Wasatch Mountains. Hazards evaluated included landslides, debris-flows, surface-fault rupture, and rock fall. Soil properties were characterized from test hole, test pit, and trench logs according to surficial geologic units. Test holes were drilled, logged, and sampled in a one-mile wide landslide in order to assess landslide characteristics and activity. Active faults were mapped from aerial photographs, and potential rock-fall areas were delineated from field surveys. Results were summarized in a report and presentations were made to the Water Users Association.

Slope Stability Modeling and Remedial Design

Landslide Analyses and Remediation, Central Utah: Conducted three separate analyses of recent landslides that occurred on a pipeline right-of-way, a reclaimed mine, and an active mine. Projects including detailed mapping of landslide features, conducting seismic profiles, installing borings and piezometers, collecting samples, conducting laboratory testing, and conducting computer stability analysis. Based on the analyses, remediation designs were developed to increase stability by controlling surface and shallow ground water, and regrading the landslides to stable configurations.

Sediment Pond Stability Evaluation, Salina, Utah: Conducted stability analysis and prepared hydraulic designs for an earth embankment of a sediment pond. Stability was evaluated for full-reservoir and rapid-drawdown conditions under static and pseudo-static scenarios. Based on these analyses, a new embankment was designed and a report was prepared including construction drawings for the embankment as well as for the primary and secondary spillway structures.

Seismic Hazard Evaluations

Liquefaction Analysis, Wasatch Front, Utah: Evaluated liquefaction potential for four sites along the Wasatch Front. Factors considered were presence and depth of liquefiable layer of loose sand identified from blow counts in previous geotechnical borings, depth of ground water, and horizontal acceleration of gravity resulting from an earthquake on nearby faults. Probability of liquefaction for specified periods of time, and the amount of settlement that would result was estimated at each site.

Fault Rupture Investigations, Western United States: Conducted aerial photo interpretation, low sun-angle aerial reconnaissance, drill log and core examination, topographic and stream channel profiling, and trench logging as part of investigations of normal and accommodation faults in Arizona, Montana, Nevada, and Utah. Have participated in, or directed, approximately 20 individual surface fault rupture investigations for projects ranging from single-family lots and commercial/industrial facilities to 50-acre subdivisions.

Paleoenvironmental Reconstruction

Investigation of Paleolakes, Central Utah: Conducted an investigation to document the presence of lacustrine ecosystems in the southern Bonneville Basin during the Paleoindian period. Sediments were retrieved from deep bore holes in four present day playas and sub basins of Lake Bonneville. Chronological control was established based on radiocarbon analysis. Paleoenvironmental conditions within the region were derived from analysis of biological and geochemical indicators preserved in the sediments.

Paleoenvironmental Reconstruction, Southeastern Wyoming: Conducted investigations to reconstruct paleoenvironmental conditions for the Snowy Range and Carbon Basin during the late Pleistocene and the Holocene. Sediment cores were retrieved from five modern lakes and sediments were analyzed for sedimentological, biological, geochemical, and isotopic indicators of past climate and environmental conditions. Chronological control was established based on radiocarbon analysis.

PUBLICATIONS

Wieczorek, G. F., Ellen, Stephen, Lips, E. W., Cannon, S. H., and Short, D. N., 1983, Potential for debris flow and debris flood along the Wasatch Front between Salt Lake City and Willard, Utah, and measures for their mitigation: U.S. Geological Survey Open-File Report 83-635, 25 p., map scale 1:100,000, Reprinted in Utah State Bar, 1983, Conference on Legal and Legislative Approaches to Western States Geological Hazards: November 1983, Salt Lake City, p. 53-116.

Lips, E. W., Wieczorek, G. F., and Boschetto, H. B., 1984, Factors influencing debris-flow runoff: Delineation of Landslides, Flash Floods and Debris Flow Hazards in Utah, Logan Utah, Abstracts, p. 9.

Wieczorek, G. F., Ellen, Stephen, Lips, E. W., Cannon, S. H., and Short, D. N., 1984, Identification of debris flow and debris flood potential along the Wasatch Front between Salt Lake City and Willard, Utah: Delineation of Landslides, Flash Floods and Debris Flow Hazards in Utah, Logan Utah, Abstracts, p. 9.

Keefer, D. K., Wilson, R. C., Harp, E. L., and Lips, E. W., 1985, Landslides in the Borah Peak, Idaho earthquake of 1983 in Reaveley, L. D., ed. The Borah Peak, Idaho Earthquake of October 28, 1983: Earthquake Engineering Research Institute Reconnaissance Report, p. 91-125.

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Lips, E. W., 1985, Landslides and debris flows east of Mount Pleasant, Utah, 1983 and 1984: U.S. Geological Survey open-File Report 85-382, 12 p., map scale 1:24,000.

Lips, E. W., 1988, Grain size parameters of debris flows and hyperconcentrated flows, in Julien, P. J., ed., Essays on River Mechanics: Colorado State University, p. 15-26.

Lips, E. W., and Keaton, J. R., 1988, Slope-a-scope: a convenient tool for rapid topographic profiling: Association of Engineering Geologists, Abstracts with Programs, p. 51.

Wieczorek, G. F., Lips, E. W., and Ellen, S. D., 1989, Debris flows and hyperconcentrated floods along the Wasatch Front, Utah, 1983 and 1984: Bulletin of the Association of Engineering Geologists, v. 26, no. 2, p. 191-208.

Lips, E. W., 1990, Characteristics of debris flows in central Utah, 1983: Fort Collins, Colorado, Colorado State University M.S. thesis, 66 p.

Lips, E. W., and Wieczorek, G. F., 1990, Recurrence of debris flows on an alluvial fan in central Utah in French, R. H., ed., Hydraulics/ Hydrology of Arid Lands: American Society of Civil Engineers, p. 555-560.

Keaton, J. R. and Lips, E. W., 1994, Why probabilistic estimates sometimes exceed deterministic estimates for the maximum earthquake acceleration: Association of Dam Safety Officials, 1994 Western Regional Conference Proceedings, p. 99-104.

Lips, E. W. and Keaton, J. R., 1994, The operating basis earthquake for dams: making sense of the numbers game: Association of Engineering Geologists 37th Annual Meeting, Program and Abstracts, p. 54.

Currey, D., Lips, E. W., Thein, B., Wambeam, T., and Nishazawa, S., 2001, Elevated Younger Dryas lake levels in the Great Basin, western U.S.A.: Geological Society of America, Abstracts v. 33, no. 6, p. A-217.

Lips, E. W., Marchetti, D. W., and Gosse, J., 2005, Revised chronology of late Pleistocene glaciers, Wasatch Mountains, Utah: Geological Society of America, Abstracts v. 37, no. 7, p. 41.

Godsey, H. S., Atwood, G., Lips, E. W., Miller, D. M., Milligan, M., and Oviatt, C. G., 2005, Don R. Currey Memorial Field Trip to the shores of Pleistocene Lake Bonneville: Geological Society of America, Field Trip Guide 6, p. 419-448.

Marchetti, D. W., Cerling, T. E., and Lips, E. W., 2005 A glacial chronology for the Fish Creek drainage of Boulder Mountain, Utah, USA: Quaternary Research 64, p. 263-271.

Exhibit B

Geo-Hydro, Inc.
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Denver CO 80206
cnorris@geo-hydro.com

Charles H. Norris, P.G.
(303) 322-3171

SUMMARY OF QUALIFICATIONS

Thirty plus years of professional experience in geology, hydrogeology and management in the applied and theoretical geosciences. Experience includes performance, oversight review, or management of site assessment; RI/FS; computer modeling of fluid flow, contaminant transport, and geochemistry (applications and code development); policy and rule making procedures; aquifer evaluation; resource development; and litigation support; nationwide and internationally.

PROFESSIONAL EXPERIENCE

GEO-HYDRO, INC., Denver, Colorado, (1996-present), Principle, CEO, Vice-President
HYDRO-SEARCH, INC., Golden, Colorado, (1992-1996), Director of Hydrogeology
UNIVERSITY OF ILLINOIS, Urbana, Illinois, (1987-1992), Research Associate; Manager, Industrial Consortium
for Research and Education for the Laboratory for Supercomputing in Hydrogeology
Consulting Hydrogeologist/Geologist, Champaign, Illinois and Denver, Colorado, (1980-1992)
MGF OIL CORPORATION, Denver, Colorado, (1985 - 1986), Manager Geological Engineering
EMERALD GAS AND OIL, Denver, Colorado, (1980 - 1986), President and Owner
PETRO-LEWIS CORPORATION, Denver, Colorado (1980), Districts Geologist
TENNECO OIL COMPANY, Denver, Colorado and Houston, Texas, (1977-1980), Senior Geological Engineer
AMOCO INTERNATIONAL OIL COMPANY, Chicago, Illinois, (1975-1977), Senior Geologist
SHELL OIL COMPANY, Houston and Midland, Texas, (1972-1975), Exploration Geologist

PROFESSIONAL REGISTRATIONS, MEMBERSHIPS, AND AFFILIATIONS

Professional Geologist: Illinois (# 196-001082), Indiana (# 2100), Kentucky (KY-2470), Pennsylvania (PG003994),
Utah (#5532631-2250), Virginia (#2801 001834), Wisconsin (# 924), Wyoming (#2989)
Registered Environmental Professional (#5350), State of Colorado, Petroleum Storage Tank Fund

National Ground Water Association
Colorado Groundwater Association (Board 2009-10, Vice President 1999, President 2000, Past-President 2001)
Professional Geologists of Indiana (past)
The Colorado Mining Association (past)
Illinois Groundwater Association (past)
American Association of Petroleum Geologists (past)

Phi Beta Kappa, Phi Kappa Phi, Sigma Xi

EDUCATION

B.S., Geology, University of Illinois, High Honors and Distinction in Geology, 1969
M.S., Geology, University of Washington, National Science Foundation Fellow, 1970
University of Illinois, all but dissertation completed for Ph. D., Hydrogeology, 1992

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PROJECT EXPERIENCE

RI/FS & GENERAL SITE INVESTIGATIONS

- ◆ Manager for technical assistance through a Technical Assistance Program (TAP) grant from PRPs to local citizens' group. Assistance through grant to provide assessment and feedback on site work products as they are developed and implemented, explain the remediation processes and activities to the citizens, and serve as technical liaison between citizens and remediation team. (Ongoing)
- ◆ Modeler and hydrogeologic consultant at industrial tank farm adjacent to the Chicago Sanitary and Ship Canal in northeastern Illinois. Assess hydrogeologic data, interpret aquifer testing, and model groundwater flow in soil and fractured carbonate bedrock in area of DNAPL accumulation as part of site characterization and voluntary remediation design. (Ongoing)
- ◆ Manager and hydrogeologist of groundwater investigation at an industrial dump site adjacent to the Illinois River in north Central Illinois. Investigated fate and transport of 3-4 decades of disposal of mixed, hazardous industrial wastes at a non-engineered floodplain dump site. Expert testimony (deposition) and legal support. Pre-trial settlement provided for installation of monitoring system in lieu of site characterization.
- ◆ Manager of groundwater flow modeling performed as part of the groundwater characterization effort and as part of the preliminary remedial designs. The site is a Superfund site involving both organic and metals contaminants at a wood treating facility in an urban area in Alabama adjacent to a major commercial waterway.
- ◆ Manager of groundwater flow modeling performed as part of the groundwater characterization effort and as part of the 90% and Final remedial designs. The site is a high profile Superfund site involving both organic and metals contaminants at a wood treating facility in Northern California.
- ◆ Technical advisor assisting in the evaluation of aquifer properties and well performances for an extraction well field near Sacramento CA. A high volume pump and treat system for chlorinated solvents showed strong and anomalous decline in productivity. Detailed evaluation identified both possible causes and recommended operations changes to alleviate the problems.
- ◆ Technical advisor assisting in the evaluation of aquifer properties and well performances for initial installation of a high volume extraction well field in Southern California. The chlorinated solvent plume associated with a Superfund site impacted a large area in a layered, heterogeneous groundwater basin managed intensively for public water supplies.
- ◆ Senior oversight and review in the evaluation of aquifer and soil properties, and the remediation of the soils contamination and groundwater impacts associated with compressor facilities of interstate gas transmission companies. Various projects and sites in western Colorado, Wyoming, and the Texas panhandle.
- ◆ Technical advisor for the Remedial Investigation/Feasibility Study (RI/FS) of the Landfill Solids and Gases Operable Units at the Lowry Landfill CERCLA site located near Denver, Colorado. This project involved the characterization of the extent of potential contamination within the unsaturated zone adjacent to this high profile site. Work involved extensive coordination and interaction with multiple PRP groups as well as various regulatory agencies.
- ◆ Project manager for independent oversight of a proposed low-level radioactive waste disposal site. Task was to develop technical and legal program for governmentally funded intervenor's case as part of adjudicatory hearings on a high-profile, proposed disposal facility and involved identifying, retaining and educating legal staff, retaining a team of technical experts, negotiating fees, coordinating work product and presentations, providing liaison with citizen's groups, responding to press and integrating personal testimony on hydrogeology and modeling. Expert testimony and legal support.

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LANDFILL SERVICES

- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment of existing water quality and off-site migration from existing licensed landfill near Joliet IL. Work includes groundwater flow modeling of remedial alternatives and groundwater impact assessments of various alternatives for submittal to IEPA. (Ongoing)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill (3 of 3) in southern Kendall County, Illinois. Expert testimony and legal support. Review identified omissions in application, faulty interpretation of site characterization data, and inappropriate modeling design and implementation. (2008)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill (2 of 3) in Kendall County, Illinois. Expert testimony and legal support. Review identified omissions in application, faulty interpretation of site characterization data, and inappropriate modeling design and implementation. (2007)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill (1 of 3) in Kendall County, Illinois. Expert testimony and legal support. Review identified omissions in application, faulty interpretation of site characterization data, and inappropriate modeling design and implementation. (2007)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed expansion for a hazardous waste landfill in Peoria County, Illinois. Expert testimony and legal support. Review identified errors in application, unaddressed contamination on facility property, and inappropriate modeling design and implementation.
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill by expansion of local landfill in Ogle County, Illinois. Expert testimony and legal support. Review identified in errors application, unaddressed existing leakage, and potential risk to public water supply. (Three hearings)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment for siting of a proposed regional landfill by expansion of local landfill in Kankakee County, Illinois. Expert testimony and legal support. Review identified errors in application, unaddressed existing off-site leakage, and inappropriate modeling design and implementation. (Two hearings)
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill in Will County, Illinois. Expert testimony and legal support. Research documented numerous errors in application which resulted in underestimation of infiltration rates and potential migration rates. Identified evidence of sub-karstic migration pathway from site to nearby stream. Assisted with the design of the facility monitoring system submitted and accepted by IEPA.
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill expansion at East Peoria, Illinois. Research documented current leakage from the existing landfill into the regional unconfined aquifer within the cone of depression of the municipal water supply wells. In part as a result of the evaluation, the proposed expansion has been abandoned. Expert testimony and legal support.
- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment of a proposed regional landfill at Ottawa, Illinois. Provided testimony at county hearings identifying and documenting site-specific conditions that invalidated part of the ground water evaluation testing, necessitating the need to re-evaluate the groundwater flow system and redesign the monitoring system. Expert testimony and legal support.

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- ◆ Project manager and hydrogeologist for a geologic and hydrogeologic assessment of existing municipal landfills and a proposed landfill redesign and expansion at Salem, Illinois. Provided testimony at city hearings documenting existing landfill leakage and identifying site-specific conditions that complicate the design of a reliable monitoring system. Expert testimony and legal support.
- ◆ Project manager and hydrogeologist for site evaluations of the geology and hydrogeology of several proposed municipal landfills and a landfill expansion in Bartholomew County, Indiana. The review of the expansion demonstrated inadequate monitoring of the existing facility. One proposed site showed possible, current ground water usage from under the proposed facility and conditions that may preclude state-level site approval.
- ◆ Project manager and hydrogeologist serving in consultation to the Board of Wayne County, Illinois, regarding a proposed expansion to a regional landfill. Investigation and oversight established viability of the physical site and improvements that were needed in operating procedures and monitoring efforts. Expert testimony and legal support.
- ◆ Project manager and hydrogeologist for an assessment of an existing regional municipal landfill at Urbana, Illinois. Principle problems included ground water contamination, unplugged well(s) within the facility boundary that penetrated the aquifer serving public water supplies and a monitoring system inadequate to evaluate the contaminant migration. Results of the evaluation include an expanded system of monitoring wells, improved protocols for ground water sampling and revised statistical procedures to determine background water chemistries.
- ◆ Project manager and hydrogeologist for a site assessment of a proposed municipal landfill expansion in west central Indiana. Established feasibility of using the engineering and design features of the expansion to prevent contamination from the pre-existing non-engineered facility.
- ◆ Project manager and hydrogeologist for a site assessment of a proposed municipal landfill expansion in Livingston County, Illinois. Principal problems involved the evaluation of the impact of shallow coal tunnel mining beneath the site and reaction of waste leachate with unusual clay mineralogy important to waste isolation at the site. Expert testimony. (1990)
- ◆ Project hydrogeologist for a site assessment of a proposed saturated-zone, regional bafefill in central Illinois. Principal problems involved the evaluation of the hydrogeologic characteristics of the strip mine spoils within which excavation would occur, the blasted mine bottom upon which the liners would be built and the materials available for liner construction. Expert testimony and legal support. (1988)
- ◆ Technical reviewer of site assessment and re-assessment of a proposed inter-governmental regional landfill in central Illinois. Verified unanticipated, politically unacceptable risks to major aquifer system serving public water supplies. Assisted in drafting of technical policy statement that permitted new siting efforts to proceed in the jurisdiction. Expert testimony.

WATER RESOURCE EVALUATION & DEVELOPMENT

- ◆ Project manager and hydrogeologist for review of an application for new surface mine in Illinois on behalf of the office of the Illinois Attorney General. The review identified probable mining-related impacts to surface and ground water from proposed mining to sensitive adjacent areas and resulted in an appeal of the permit approval. Expert testimony. (2008)
- ◆ Project manager and hydrogeologist for review of an application for new long-wall mine in West Virginia. The review identified unrecognized mining-related impacts to water discharges from proposed mining, identified geotechnical risks to adjacent, down-dip river banks, and resulted in an appeal of the permit approval. Expert testimony at two hearings and legal support. (2008, 2007)
- ◆ Manager for ground water modeling effort associated with the development of a high-volume ground-water supply and delivery project in Colorado. The effort included investigating and evaluating a previously

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used, court-accepted model, adapting and updating the model, and applying the model to assess the impacts of a proposed private ground-water diversion project that would be the largest in the United States. Ongoing effort includes subsequent review of alternative proposed model and further litigation support.

- ◆ Manager for review of an application for an expansion of a large long-wall mine in southeastern Ohio. The review identified extensive unrecognized mining-related impacts to water supplies from historic mining and identified hydrologic risks to a unique old-growth forest adjacent to the proposed expansion, and resulted in an appeal of the application. Expert testimony and legal support.
- ◆ Manager for ground water modeling effort associated with the development of a surface reservoir designed for conjunctive use of ground and surface water to reduce peak ground water pumping demands in Denver metro area. The effort included investigating and evaluating a previously used, model, adapting and updating the model, and applying the model to assess the impacts of project on other water rights. Study is a component of the EIS.
- ◆ Project Manager for multi-company effort to model thermal loading of northern Nevada surface waters as a result of mine dewatering project. Successful liaison among technical staffs and regulators and modeling work for a high profile EIS resulted in approval of discharge permit.
- ◆ Project Hydrogeologist for the feasibility study of a small lake for a northern Illinois nursery, to be used for recreation and irrigation. Evaluated shallow and intermediate ground water and surface run-off, reviewed engineering design and directed ground and surface water sampling program to determine nutrient levels.

HYDROCHEMISTRY

- ◆ Project manager, hydrogeologist, geochemist for ongoing investigation of metals contamination of a trout stream in West Virginia. Impacts from natural and industrial sources, present and past, evaluated to segregate relative significance of various sources. Includes expert testimony and legal support. (Ongoing)
- ◆ Project geochemist and hydrogeologist for evaluation and critique of site characterization methodology used by Department of Defense (Army) for closure of artillery range for depleted uranium projectiles. Identified errors in methodology and data interpretation that led to hearings before the USNRC Atomic Safety and Licensing Board. Expert testimony and legal support. (2007)
- ◆ Principal investigator for grant to research the geochemical implications of using alkaline addition as one means for preventing and/or remediating inorganic contamination resulting from acid mine/rock drainage. Empirical and modeling evidence showed conditions under which alkaline addition can cause or exacerbate contamination of some constituents of concern.
- ◆ Project geochemist and hydrogeologist for evaluation and critique of modeling protocols used by USEPA for risk assessments performed as part of regulatory determinations for various solid wastes. Identified errors in methodology and input that had caused previous modeling to mischaracterize risks for settings with observed damage cases. Computer modeling.
- ◆ Geochemist and hydrogeologist for evaluations of inorganic groundwater chemistry at an industrial RCRA site near Joplin MO. Federal lawsuit filed pursuant to PRP contribution and sources and timing of contamination. Was able to use geochemical interpretations to establish significant elements of aquifer characteristics and implications for contamination routes. Expert testimony.
- ◆ Project hydrogeologist and geochemist for evaluations of proposed coal combustion waste disposal as part of reclamation activities at surface coal mines in Southwestern Indiana. Efforts were targeted toward refining regulatory framework for disposal efforts, establishing effective characterization and monitoring programs and determining appropriate operation and engineering practices. Project involved extensive interdisciplinary effort and expert testimony.
- ◆ Project geochemist for the investigation of the impacts of remediating acid mine drainage by installing bulkheads to flood exhausted mine working. Predictively modeled water chemistries in situ, within flooded

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mine, along flow paths and upon surface discharge. Assisted in preparation of testimony that resulted in permit approval for the San Juan County, Colorado project.

- ◆ Project manager and project geochemist/hydrogeologist for investigation of potential environmental impacts of disposal of coal combustion wastes (CCW) as part of a reclamation plan at a surface coal mine in northern New Mexico. Performed or directed geochemical, infiltration and flow modeling of the proposed project to identify optimum disposal methods and worst case impacts. Presentation to State resulted in approval of this precedent-setting project.
- ◆ Project manager, geochemist/hydrogeologist Investigating a proposed disposal/construction project for a central Illinois ski mountain from co-generation fly ash from a major food products manufacturer. Involved overseeing an engineering review of project plans, site investigation and evaluation, geochemical modeling of initial and final mineralogical composition of the mass and of the leachate chemistry and evolution and the impact on the hydrogeologic and structural integrity of the project. Expert testimony and legal support.

RELATED PETROLEUM INDUSTRY EXPERIENCE

- ◆ Project manager for the environmental assessment of 82 Texas producing properties targeted for acquisition. Evaluations included site walk-overs, surface soil and liquid sampling, radiological monitoring and geoprobe sampling of soils and ground water. The assessments documented a multitude of impacts from both exempt and non-exempt wastes that, unrecognized, could have resulted in substantial financial exposure to the client.
- ◆ Project geologist and petrophysicist for an investigation of resource potential of coal bed methane in San Juan Basin of New Mexico and Colorado. Study focused on innovative log analysis techniques; formation water chemistries, production rates and disposal problems; well drilling, completion and re-completion practices; and detailed subsurface facies and structural mapping and stratigraphic correlation in shallow coal beds of Kirtland/Fruitland/Pictured Cliffs shoreline complex and relationships to overlying Tertiary sandstones.
- ◆ Developed a successful play in the Hunton and Mississippi Lime formations of northwest Oklahoma. The play recognized the secondary porosity systems of both formations (dolomitization and fracturing, respectively) and the genetic significance to each of the buried topography at the intervening unconformity.
- ◆ Managed a detailed reservoir study of a Cotton Valley gas field in east Texas that resulted in RRC approval of non-standard spacing based upon the recognition of secondary porosity and a dual-conductivity system that resulted from drape-induced fractures. The revised spacing both protected resource ownership and conserved the costs of infill drilling. Expert testimony and legal support.
- ◆ Project geologist, petrophysicist and expert witness for various contested adjudicatory hearings apportioning oil and gas ownership. Cases involved primary recovery of oil/gas and secondary recovery of oil. Accepted as expert (geology, hydrogeology, and/or geological engineering) in Oklahoma, Texas, and Wyoming.

ADDITIONAL PROFESSIONAL EXPERIENCE

- ◆ Appointed member of a Technical Review Committee of the Virginia Department of Environmental Quality. The committee, comprised of state regulators, industry generators, users, and intervenors, was charged with reviewing commonwealth rules practices for placement of coal combustion byproducts as fill material and recommending changes for that program (2008).
- ◆ Provided invited testimony before U.S. Congressional Subcommittee on Energy and Mineral Resources oversight hearings on addressing health and environmental risks of coal combustion waste. (2008).
- ◆ Invited presenter to National Research Council of the National Academy of Sciences, Committee on Mine

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Placement of Coal Combustion Wastes.

- ◆ Appointed member of a Quality Assurance Committee under the West Virginia Department of Environmental Protection. The committee, comprised of representatives of state and federal regulators, industry, and interveners, was charged with a year-long review of state mining applications and approval practices relative to mining under the state and federal surface mining laws.
- ◆ Invited presenter to National Research Council of the National Academy of Sciences, Subcommittee on Alternatives, Study on Coal Waste Impoundments.
- ◆ Project manager and hydrogeologist for the review of Proposed and Revised Proposed Criteria for the Siting of a Low Level Radioactive Waste Disposal Facility in Illinois. Evaluation was targeted toward both technical content and processes of selection. Testimony and written comments led to significant improvements and flexibility in the Criteria as finally published.
- ◆ Project hydrogeologist testifying at hearings before the Illinois Pollution Control Board on regulatory language for the Illinois Ground Water Protection Act. Contributed major conceptual and specific language changes to the final promulgated rules for Ground Water Quality Standards and Regulations for Existing and New Activities with Setback Zones and Regulated Recharge Areas. Expert testimony and legal support.
- ◆ Project hydrogeologist and log analyst for three applications to U.S. EPA for permits to continue deep well disposal of hazardous wastes in east central Illinois and southern Ohio. Project required evaluation of geophysical logging data to determine injection zone and confining layer properties, regional flow systems, chemical interactions of the waste stream with the native rock and the ability of the injection system to isolate the waste from the environment.

REPORTS, PRESENTATIONS, AND PUBLICATIONS

- Norris, Charles H., 2008, "Remediating Acid Mine Drainage with Alkaline Addition", in Proceedings of Remediation of Abandoned Mine Lands Conference, United States Environmental Protection Agency and National Ground Water Association, at NGWA's Ground Water Online(R) website. Presented in conference at Denver CO, October 3, 2008
- Norris, Charles H., 2005, "Water Quality Impacts from Remediation Acid Mine Drainage with Alkaline Addition", draft version released to National Research Council of the National Academy of Sciences, Committee on Mine Placement of Coal Combustion Wastes, Geo-Hydro, Inc., Denver CO, July 3, 2005
- Norris, C. H., "notes from the front. . . Overview of three sites", invited paper before National Research Council of the National Academy of Sciences, Committee on Mine Placement of Coal Combustion Wastes, Evansville IN, March, 2005.
- Norris, Charles H., 2004, "Environmental Concerns and Impacts of Power Plant Waste Placement in Mines", Presented at Harrisburg PA, May 4-6, 2004. Published in Proceedings of State Regulation of Coal Combustion By-Product Placement at Mine Sites: A Technical Interactive Forum, Kimery C Vories and Anna Harrington, eds, by U. S. Department of Interior, Office of Surface Mining, Alton IL, and Coal Research Center, Southern Illinois University, Carbondale IL.
- Norris, C. H., "Developing Reasonable Rules for Coal Combustion Waste Placement in Mines. Why? When? Where? How?", USEPA Contract 68-W-02-007, IEI Subcontract 7060-304, Invited paper at USEPA MRAM meeting, Rosslyn VA, September, 2003.
- Norris, C. H., "So, You think You're a Geologist? (F. Kafka to A. Liddell, In Wonderland)", Colorado Ground Waster Association Monthly Meeting,, Denver CO, September, 2002.
- Norris, C. H., "Assessment of the Anker Energy Corporation proposal for mining and reclamation, Upshur County, West Virginia." Independent evaluation on behalf of Anker Energy Corporation and West Virginia

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Highlands Conservancy , July, 2002.

Norris, C. H., "Coal Combustion Waste: Coming soon to a neighborhood (and maybe a faucet) near you." Colorado Ground Water Association Monthly Meeting,, Denver CO, May, 2001.

Norris, C. H., "Slurry-to-ashes, and ashes-to . . . A case of a coal company and citizens working together to evaluate alternatives." Invited paper before National Research Council of the National Academy of Sciences, Subcommittee on Alternatives, Study on Coal Waste Impoundments, St. Louis MO, June, 2001.

Norris, C.H., and C. E. Hubbard, "Use of MINTEQA2 and EPACMTP to Estimate Groundwater Pathway Risks from the Land Disposal of Metal-Bearing Wastes", for Environmental Technology Council, submitted as public comment to USEPA on regulatory determination for Fossil Fuel Combustion Wastes, May, 1999.

Norris, C.H., "Report on the Determination of Intermittent Streams and the Potential Impacts of Valley Fill on Area Drainages, Southern West Virginia", expert report for litigation prepared for Mountain State Justice, Inc, Charleston WV, March, 1999.

Norris, C.H., "Report on the Geology and Hydrogeology of the Caterpillar Levee Site with an Evaluation of Potential Pathways on- and off-site for the Movement of Solid and Hazardous Wastes", expert report for litigation prepared for Citizens for a Better Environment, Chicago IL, March, 1998.

Norris, C.H., "Dr Pepper, Biorhythms, and the Eight-Hour Pumping Test ", Colorado Ground Water Association Annual Meeting, Golden CO, December, 1997.

Norris, C.H., "Characterizing Ash Composition and (vs.) Projecting Environmental Impact for Purposes of Permitting CCW Disposal ", Coal Combustion By-Products Associated with Coal Mining - Interactive Forum, Southern Illinois University at Carbondale, Carbondale IL, October, 1996.

Norris, C.H., "Geochemical Modeling". Co-instructor for Short Course on Hydrogeologic Issues Related to Mine Permitting, Reclamation and Closure, SME Annual Convention, Phoenix AZ; March, 1996.

Norris, C.H., An Improved Method for Middle Time Analysis of Slug and Bail Test. Unpublished. 1994.

Norris, C.H., "Evolution of the Landfill", presentation as part of a Telnet program, *Garbage Dilemma Educational Series*, sponsored by Illinois Farm Bureau and Cooperative Extension Service of the College of Agriculture, University of Illinois, Urbana, Illinois, April 20, 1992.

Norris, C.H., "Technical Analysis or Political Acceptability: The Domesticated Fowl or its Ovum", Solid Waste Management and Local Government Workshop, sponsored by Institute of Government and Public Affairs, University of Illinois, Urbana, Illinois, Jan-Apr, 1992.

Norris, C.H., Report on the Geology and Hydrogeology [of the] SWDA Proposed Landfill Site, Township 8 North, Range 6 East, Section 31, Bartholomew County, Indiana, for Central States Education Center, Champaign, Illinois, 1991.

Norris, C.H., Hydrogeology and Modeling of the Proposed Illinois Low Level Radioactive Waste Disposal Site at Martinsville, Illinois; testimony before the LLRW Siting Commission, October and November, 1991, Martinsville, Illinois.

Norris, C.H., Ground Water Quality Standards for the Illinois Ground Water Protection Act; testimony before Illinois Pollution Control Board, Chicago, Illinois; February, May, October and December, 1990; May, 1991.

Norris, C.H., Hearing on a Petition for a Special Use Permit for the Construction of a Ski Mountain in Oakley Township, Macon County, Illinois; testimony before the Macon County Zoning Board of Appeals; February 16, 1990.

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- Norris, C.H., In the matter of the Gallatin National Company Proposed Balefill, Fulton County, Illinois, written comments to the Illinois Environmental Protection Agency, Springfield, Illinois, 1990.
- Norris, C.H., 1990, Log Analysis of the Allied Chemical Corporation Waste Injection Well, Danville, Illinois, for Alberto Nieto, Champaign, Illinois.
- Norris, C.H., 1989, Log Analysis of the Cabot Corporation Waste Disposal Wells, Tuscola, Illinois, for Alberto Nieto, Champaign, Illinois.
- Norris, C.H., Regulations for Existing and New Activities Within Setback Zones and Regulated Recharge Areas for the Illinois Ground Water Protection Act; testimony before Illinois Pollution Control Board, Chicago, Illinois, June, 1989.
- Norris, C.H., and C.M. Bethke, (Abstract) "Mathematical Models of Subsurface Processes in Sedimentary Basins", Conference on Mathematical and Computational Issues in Geophysical Fluid and Solid Mechanics, Society for Industrial and Applied Mathematics Annual Meeting, Houston, Texas, September 28 (invited paper), 1989.
- Norris, C.H., "An Evaluation of the Geology and the Monitoring Well Data [at the] City of Urbana Regional Landfill", report submitted to the City of Urbana, Champaign County, Illinois, for Central States Education Center, Champaign, Illinois, 1989.
- Norris, C.H., "Evaluation of the Hydrogeologic Factors Influencing Risk [at the] ISWDA Regional Landfill Site B", report submitted to the Inter-Governmental Solid Waste Disposal Association, Champaign County, Illinois, 1988.
- Norris, C.H., and C.M. Bethke, "Status and Future Directions of Quantitative Flow Modeling in Sedimentary Basins", Workshop on Quantitative Dynamic Stratigraphy (QDS), Colorado School of Mines, Lost Valley Ranch, Colorado, February 14-18, 1988.